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*Japanese and World Technology Evaluation Centers***JTEC  
WTEC***JTEC/WTEC Panel Report on***Rapid Prototyping in Europe and Japan****VOLUME I. ANALYTICAL CHAPTERS**

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**METAL CASTING APPLICATIONS IN THE UNITED STATES****Investment Casting**

The United States is clearly the world leader in the use of rapid prototyping processes for metal casting applications. Metal casting from RP patterns is widely used by government and industry, cross-cutting numerous markets, including those for automotive, aerospace, medical, and consumer products. The use of RP patterns for investment casting continues to increase as processes evolve and pattern quality improves. There is already a significant number of U.S. companies applying RP to metal casting, as Table 10.1 shows. 3D Systems' stereolithography (SL) process is often used to fabricate patterns for investment casting. The QuickCast build style, coupled with CibaTool and other epoxy resins, is now used by many U.S. companies to fabricate complex patterns quickly for investment casting of metal parts. DTM Corporation's Selective Laser Sintering (SLS) process is used to fabricate investment casting patterns from several materials, including investment casting wax, polycarbonate, and a recently released proprietary material called TrueForm. The use of the SLS process to fabricate investment casting patterns continues to increase as material performance and accuracy improve. To date, however, far fewer SLS machines are in use than SL machines. Other RP processes used in the United States to fabricate investment casting patterns include Stratasys' Fused Deposition Modeling (FDM); Helisys' Laminated Object Manufacturing (LOM); Cubital's Solid Ground Curing (SGC); Sanders Prototype's Model-maker; and BPM (Ballistic Particle Manufacturing) Technology's process. The Soligen Direct Shell Production Casting (DSPC) process yields investment cast parts by directly fabricating an investment casting mold without the use of a pattern.

**Table 10.1**  
**U.S. Rapid Prototyping Manufacturers' Applications for Metal Casting**

| <b>Rapid Prototyping Process</b>        | <b>Metal Casting Application</b>  |
|---|---|
| 3D Systems Stereolithography            | QuickCast patterns for investment casting<br>Epoxy patterns for precision sand casting and soft tooling   |
| DTM Selective Laser Sintering           | Investment casting wax, polycarbonate, and TrueForm patterns for investment casting<br>TrueForm, composite nylon, polycarbonate for precision sand casting and soft tooling<br>RapidTool for hard tooling investment casting patterns |
| Stratasys Fused Deposition Modeling     | Wax patterns for investment casting   |
| Helisys Laminated Object Manufacturing  | Laminated paper master patterns for sand casting, limited use for investment casting  |
| Soligen Direct Shell Production Casting | Ceramic investment casting mold fabricated directly from CAD solid model  |
| Cubital Solid Ground Curing             | Patterns for flask mold casting; process for fabricating wax investment casting patterns under development  |
| BPM Ballistic Particle Manufacturing    | Wax patterns for investment casting   |
| Sanders Model-Maker 3D Plotting         | Wax patterns for investment casting   |

**METAL CASTING APPLICATIONS IN EUROPE (GERMANY AND FRANCE)**

In Europe the use of RP for investment casting is limited but increasing. As the use of CAD solid modeling increases, application of rapid prototyping for manufacturing metal investment castings will also increase. Table 10.2 summarizes some German-manufactured rapid prototyping systems.